

NEW CYCAD (ZAMIACEAE) REPORTS FROM CHIAPAS,
OAXACA, AND TABASCO, MEXICO

ANDREW P. VOVIDES

Instituto de Ecología, A.C., Apdo Postal 63,
Xalapa, Veracruz, 91000 Mexico
e-mail: vovidesa@ecologia.edu.mx

MIGUEL ANGEL PÉREZ-FARRERA

Universidad de Ciencias y Artes del Estado de Chiapas,
Calz. Samuel León Brindis 151, A.P. 57, Tuxtla Gutierrez,
Chiapas 29000, México

CARLOS IGLESIAS AND SERGIO AVENDAÑO REYES

Instituto de Ecología, A.C., Apdo Postal 63,
Xalapa, Veracruz, 91000 Mexico

SILVIA SALAS MORALES

SERBO, A.C., Porfirio Díaz 211, Oaxaca 68000, Mexico

ABSTRACT. New localities are reported for three cycad species in Mexico. *Ceratozamia miqueliana* was found in montane rainforest in western Chiapas and *C. norstogii* was found in dry tropical oak forest mixed with elements of seasonally dry tropical forest in eastern Oaxaca. *Zamia splendens* was found on karstic topography in lowland tropical rainforest in the hills of southern Tabasco. The additional data are encouraging regarding prospective survival of the species, but small population sizes make them vulnerable to any habitat disturbance.

Key Words: Cycads, *Ceratozamia*, *Zamia*, Zamiaceae, flora, endangered species, Mexico

During the revision of the genus *Ceratozamia* in southern Mexico, we came across a population of *Ceratozamia* with wide and oblanceolate leaflets. The plants were medium-sized to large with epigeal trunks of up to 50 cm long with an open crown of about nine spreading leaves. This was a small population of approximately 200 plants in montane rainforest in Chiapas. Upon comparing this population with the recently described *C. zoquorum* Pérez-Farrera, Vovides & Iglesias from the northern mountains of Chiapas, we found that it differed in leaf, leaflet, and cone morphology. Upon further examination of the plants and herbarium vouchers, we came to the conclusion that the individuals in this population belonged in *C. miqueliana* H. Wendl. (Table 1). The

Table 1. Comparison of *Ceratozamia miqueliana*, *C. norstogii*, and *C. zoquorum*.

Species	Leaflets and Rachis	Megastrobilus Peduncle (at maturity when fresh)
<i>C. miqueliana</i>	Obovate to widely oblanceolate, chartaceous, rachis not spirally twisted	Erect
<i>C. norstogii</i>	Linear, coriaceous, rachis spirally twisted	Erect
<i>C. zoquorum</i>	Oblong to oblanceolate, very coriaceous, rachis not spirally twisted	Divaricate to descending

origin of the specimens of *C. miqueliana* given by Wendland (1854) was *patria ignota*, or country unknown. However, the description by De Candolle (1868) and an illustration of this species in Dyer (1882–1886), as well as a mention of the country of origin, conformed to plants from the neotype locality of Stevenson and Sabato (1986) in Veracruz, Mexico (see also Vovides et al. 1983).

Ceratozamia norstogii D. W. Stev., described from a locality in Chiapas (Stevenson 1982) and commented on by Pérez-Farrera et al. (2001), is a very distinct cycad with an erect, unbranching trunk. Its leaves have narrow, channeled leaflets arranged on a spirally twisted rachis. A small population of less than 100 individuals of this distinct species was found in dry tropical oak forest mixed with elements from tropical deciduous forest in eastern Oaxaca at elevations between 800–1600 m.

During other explorations into Tabasco we came upon a *Zamia* with large shiny leaflets in the southern regions of the state. It had erect to arching red-brownish emergent leaves and large elliptic to oblanceolate, heavily serrulate leaflets with exceptionally shiny adaxial cuticles. This plant differed greatly from *Z. loddigesii* Miq. and *Z. cremnophila* Vovides, Schutzman & Dehgan (Table 2), hitherto the only zamias known from Tabasco. *Zamia loddigesii* has short, erect leaves with linear-lanceolate to lanceolate leaflets not exceeding 2 cm wide, and *Z. cremnophila* has long, decumbent leaves with long-lanceolate to oblong leaflets over 2 cm wide. Upon further examination we concluded that this *Zamia* belonged in *Z. splendens* Schutzman, originally described from Chiapas (Schutzman 1984).

Table 2. Comparison of *Zamia cremnophila*, *Z. loddigesii*, and *Z. splendens*.

Species	Leaflets	Megastrobili (at maturity when fresh)
<i>Z. cremnophila</i>	Narrowly-lanceolate, imbricate, not glossy	Dark brown, tomentulose
<i>Z. loddigesii</i>	Linear-lanceolate to lanceolate, not imbricate, not glossy	Light brown, tomentulose
<i>Z. splendens</i>	Long-elliptic, oblong, oblanceolate, not imbricate, glossy	Dark green, glabrescent

DESCRIPTIONS

Ceratozamia miqueliana H. Wendl., Index Palm. 68. 1854. NEOTYPE: MEXICO. Veracruz: Santiago Tuxtla, 5 Jul 1983, *D. W. Stevenson 542F* (NY!).

Medium-sized plants with epigeal trunks becoming cylindrical with age, 6–15 cm in diameter and up to 40 cm or more long. Leaves 4–21, spirally arranged, forming an open crown, glaucous and pilose when young, 118–224 cm long, 40–70 cm wide; petiole and rachis ascending to spreading, armed with short to long stout prickles. Leaflets 9–20, obovate to widely oblanceolate, more or less chartaceous, with the proximal margin repand and sometimes coarsely unidentate near apex, 23.5–36.4 cm long, 4–6.7 cm wide, apex strongly asymmetrical, number of veins 24–39. Microstrobilus cylindrical to narrowly conical, yellow to light green, 32–45.5 cm long, 3.2–4 cm in diameter, peduncle erect, 0.8–1.5 cm long, 0.5–1.6 cm in diameter, tomentose; microsporophylls cuneiform, 1.1–1.7 cm long, 0.8–1.3 cm wide, distal face hexagonal, bicornate, long axis 0.4–0.6 cm, short axis 0.2–0.4 cm, horns short, ca. 0.2 cm, distance between horns 0.4–0.6 cm. Megastrobilus cylindrical, dark to olive-green, 28.5–30 cm long, 10–12 cm in diameter, peduncle erect at maturity, 4.5–5.2 cm long, 3.4–3.7 cm in diameter; megasporophylls peltate, 5–5.7 cm long, 2.3–2.5 cm wide, distal face hexagonal, bicornate, long axis 3.7–5.5 cm, short axis 2.2–2.6 cm, horns short, ca. 0.2 cm, distance between horns 1.3–2.2 cm. Seeds 2.9–3.3 cm long, 1.4–1.7 cm in diameter.

Coning period is from February to August.

SPECIMENS EXAMINED: MEXICO. Chiapas: Ocozocoautla de Espinosa, 23 Oct 1997, *R. A. Galdámez 04* (UNICACH). Veracruz: Moloacán, 19 Dec 1974, *J. D. Rees 1657, 1658* (XAL, MEXU). Tabasco: Huimanguillo, 22 Feb 1972, *H. Puig 638* (MEXU); 2 Mar 1972, *H. Puig 657* (MEXU); 4 Apr 1972, *H. Puig 751* (MEXU).

Ceratozamia norstogii D. W. Stev., *Brittonia* 34: 181–184. 1982. TYPE: MEXICO. Chiapas: Rancho Fenix, Mar–Apr 1925, *C. A. Purpus* 6 (HOLOTYPE not seen: NY; ISOTYPE: US!).

Medium to large plants with partially subterranean, subglobose, unbranched trunks becoming cylindrical with age, up to 22 cm in diameter and 130 cm long. Leaves 15 or more, forming an erect crown, pinnate, 70–135 cm long, 52–95 cm wide. Petiole and rachis spirally twisted. Leaflets 33–65 pairs, linear, heavily channeled, 22.8–57 cm long, 0.3–0.5 cm wide. Microstrobilus conical, olive-green to light green when immature, creamy yellow to pale yellow when mature, 25–36 cm long, 3.8–6.2 cm in diameter, peduncle tomentose, ca. 4.4–7.2 cm long; microsporophylls cuneiform, 1.6–1.9 cm long, 0.7–1.2 cm wide, distal face hexagonal, bicornate, short axis 0.5–0.6 cm, long axis 0.7–1.2 cm, horns 0.1–0.2 cm long, distance between horns 0.2–0.5 cm. Megastrobilus cylindrical to barrel-shaped, olive-green when immature, dark brown when mature, 14.5–37 cm long, 7.4–13 cm in diameter, peduncle tomentose, 6.1–10 cm long, ca. 1.5 cm in diameter; megasporophylls peltate, 2.8–4 cm long, distal face hexagonal, bicornate, short axis 1.3–1.4 cm, long axis 2.3–2.2 cm, horns 0.3–0.9 cm long, distance between horns 0.6–1.2 cm. Seeds ovoid angular, 2.4–2.9 cm long, 1.5–2.1 cm in diameter, with 6–11 radial lines radiating from the micropile.

Coning period is from March to October.

SPECIMEN EXAMINED: MEXICO. Oaxaca: San Miguel Chimalapa, Mar 1996, *S. Salas-Morales* & *E. Torres* H. 1173 (SERBO).

Zamia splendens Schutzman, *Phytologia* 55: 299–304. 1984. TYPE: MEXICO. Chiapas: Cultivated, Apr 1984, *J. Watson* 1870 (HOLOTYPE: NY!; ISOTYPES: FLAS, MEXU).

Small to medium plants up to 1 m tall (2 m under cultivation) with subterranean stems, sometimes branching. Leaves 2–4 per crown, bright red to salmon pink or green at emergence, up to 80 cm or more long, 18–80 cm wide. Leaflets 4–10 pairs, long-elliptic to oblong or oblanceolate, 9–40 cm long, 3–10 cm wide, margin serrulate-denticulate. Microstrobili two or more per stem apex, conic, light brown tomentulose, up to 5 cm long and 1.3 cm in diameter; peduncles 8–14 cm long, strongly decumbent and pushing the cone into loose surface humus; microsporophylls cuneate, 0.4–0.5 cm long, distal face hexagonal in outline, with smooth dome-shaped surface, long axis 0.3–0.4 cm, short axis 0.15–0.3 cm. Megastrobili subglobose or ellipsoid, with apical projection, up to 8 cm long and 4.5 cm in diameter, dark green, glabrescent; megasporophylls

peltate, 1.8–2.2 cm long, distal face hexagonal, with dome-shaped surface, long axis 1.8–2 cm, short axis 1–1.5 cm. Seeds obovoid, sarcotesta pink to red when ripe, ca. 1.5 cm long and 0.6 cm in diameter.

SPECIMENS EXAMINED: MEXICO. Tabasco: Macuspana, 30 May 2000, A. Vovides, C. Iglesias & V. Luna 1344 (XAL); Teapa, 18 Oct 1993, C. Hubbuch & T. Walters 171A (FTG, XAL). Chiapas: Tila, 30 May 2000, A. Vovides, C. Iglesias & V. Luna 1340 (XAL).

DISCUSSION

Ceratozamia miqueliana was considered endemic to southern Veracruz. It is extremely rare there and known from only three localities. It was reported for the neighboring state of Tabasco in the early 1970s (*H. Puig* 638, 657, 751, MEXU). We returned recently to the Puig locality and other surrounding areas in Tabasco to search for this species; none was found, and we conclude that the species has probably been extirpated in Tabasco. However, the occurrence of *C. miqueliana* in a newly discovered locality in Chiapas, thus increasing its known range of distribution, has increased the probability of the species' survival. *Ceratozamia miqueliana* comprises a complex of species with obovate, oblanceolate to widely oblanceolate leaflets of which *C. euryphyllidia* Vázq. Torres, Sabato & D. W. Stev., *C. zoquorum*, and an undescribed species of *Ceratozamia* are members. All these species appear to be endemic to the region of highest precipitation in lowland Mexico that comprises the "arc refuge" area of Wendt (1987), extending from northern Oaxaca through southern Veracruz and northern Chiapas. Southeastern Mexico is rich in endemics and includes some Pleistocene refuges (González and Vovides 2002; Toledo 1982).

Ceratozamia norstogii and *Zamia splendens*, both thought to be endemic to Chiapas, are known to have wider distributions, extending into Oaxaca and Tabasco respectively. However, the small size of the population in Oaxaca renders it particularly vulnerable to habitat disturbance or commercial collecting. *Zamia splendens* in Tabasco is under great threat owing to limestone exploitation for cement manufacture in one of its more important localities.

Unexpected findings are more common during explorations into the more inaccessible and often rocky zones, especially in areas of rich biodiversity within Veracruz and Chiapas. Owing to the absence of recent explorations, rare endemics have been thought to have become extinct because of their poor representation in herbaria (Sosa et al. 1998). Precise locality information on these cycads has been purposely omitted in order to avoid illegal commercial collecting of these endangered species.

ACKNOWLEDGMENTS. The principal author acknowledges CONACYT grant No. 29379N to finance cycad research in Mexico, and Sistemática Vegetal 902-14 INECOL for the loan of a field vehicle.

LITERATURE CITED

- DE CANDOLLE, A. 1868. *Prodromus* 16: 547.
- DYER, W. T. T. 1882–1886. Cycadaceae. *Biol. Cent.-Amer., Bot.* 3: 192.
- GONZÁLEZ, D. AND A. P. VOVIDES. 2002. Low intralineaage divergence in the genus *Ceratozamia* Brongn. (Zamiaceae) detected with nuclear ribosomal DNA ITS and chloroplast DNA *trnL-F* non-coding region. *Syst. Bot.* 27: 654–661.
- PÉREZ-FARRERA, M. A., A. P. VOVIDES, AND C. IGLESIAS. 2001. The cycad *Ceratozamia norstogii* Stevenson (Zamiaceae) from southern Mexico: New information on distribution, habitat, and vegetative morphology. *Bot. J. Linn. Soc.* 137: 71–76.
- SCHUTZMAN, B. 1984. A new species of *Zamia* L. (Zamiaceae, Cycadales) from Chiapas, Mexico. *Phytologia* 55: 299–304.
- SOSA, V., A. P. VOVIDES, AND G. CASTILLO-CAMPOS. 1998. Monitoring endemic plant extinctions in Veracruz, Mexico. *Biodivers. Conservation* 7: 1521–1527.
- STEVENSON, D. 1982. A new species of *Ceratozamia* (Zamiaceae) from Chiapas, Mexico. *Brittonia* 34: 181–184.
- AND S. SABATO. 1986. Typification of names in *Ceratozamia* Brongn., *Dioon* Lindl., and *Microcycas* A. DC. *Zamiaceae*. *Taxon* 35: 578–584.
- TOLEDO, V. M. 1982. Pleistocene changes of vegetation in tropical Mexico, pp. 93–111. *In*: G. T. Prance, ed., *Biological Diversification in the Tropics*. Columbia Univ. Press, New York.
- VOVIDES, A. P., J. D. REES, AND M. VÁZQUEZ-TORRES. 1983. *Zamiaceae*. *Flora de Veracruz Fascicle* 26: 10–11.
- WENDLAND, H. 1854. *Index Palmarum*. Hannover (in *libraria aulica Hahnii*). [*Ceratozamia miqueliana*, p. 68]
- WENDT, T. 1987. Las selvas de Uxpanapa, Veracruz-Oaxaca, México: Evidencia de refugios florísticos Cenozoicos. *Anales Inst. Biol. Univ. Nac. Auton. Mexico, Bot.* 58: 29–54.